

The genus *Cirsotrema* (Gastropoda: Epitoniidae) in the Panamic Province, with the description of two new species

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ABSTRACT. Three species of *Cirsotrema* from the Panamic Province are recognized; two new species are described. *Cirsotrema togatum* Hertlein & Strong, 1951, traditionally treated as a single species complex, is separated into three distinct, sympatric species: *C. togatum*, *C. hertzae* n.sp., and *C. skoglundae* n.sp.

INTRODUCTION

Although the molluscan fauna of the Panamic Province has been extensively treated by Keen, its great extension, from Magdalena Bay, Gulf of California to Punta Aguja, Peru (Keen, 1971: 4), allows one to assume that many discoveries are still to be made, particularly since relatively little has been done in terms of formal exploration in the last decades. Until recently there has been a paucity of material of the genus *Cirsotrema* available in research institutions. Presumably, this is why the two new species described herein, formerly considered variations of *Cirsotrema togatum* Hertlein & Strong, 1951, have been overlooked.

The two earliest images of *Cirsotrema togatum* available in literature, other than the holotype, are a paratype from Costa Rica figured by Hertlein & Strong (1951:89, fig. 5), and a specimen from Panama figured by Olsson (1971:77, fig.77). These images are consistent with the original description and with the image of the holotype; however, a voucher specimen of *C. "togatum"*, CAS 06518, is referable to *C. hertzae* n.sp. (Skoglund & Hertz, 2010: 24) described herein. Moreover, the important publication by DuShane (1974) on the Panamic-Galapagan Epitoniidae depicts as *C. togatum* images of two distinct species, *C. togatum* (pp. 34-35, fig. 55) and *C. hertzae* (pp. 34-35, fig.54); and her "Diagnosis" of *C. togatum* (p. 48) includes characters of the new species that were not established by Hertlein & Strong.

In 2009 Carol Skoglund and Carole Hertz contacted me regarding a dilemma they had encountered concerning three "forms" of *Cirsotrema togatum*. Mrs. Skoglund and her husband, the late Paul Skoglund, had been collecting mollusks in the Panamic Province for many years, and had amassed an extensive and important collection of shells from the region. The genus *Cirsotrema* was very well represented, and there were examples of the three species treated in this paper. Skoglund and Hertz expanded their research to cover a number of museums and private collections, particularly the important Epitoniidae collection

housed at the Santa Barbara Museum of Natural History, which included specimens from the DuShane, Koch, Poorman, Shasky and Shy collections. Their "preliminary" researched study (2010) induced me to write this paper.

After publishing their study, Mrs. Skoglund donated her collection to the Santa Barbara Museum of Natural History, adding 25 specimens of *Cirsotrema* spp. to the museum's collection. In turn, the museum has allowed me to examine all of its *Cirsotrema* holdings from the Panamic Province.

All three species studied here inhabit most of the Panamic Province, from the Gulf of California to Panama. The three species live sympatrically at Bahía de los Angeles, Gulf of California, and *Cirsotrema hertzae* and *C. skoglundae* have been dredged together at Islas Secas, Bahía de Chiriquí, Panama.

I am honored to describe the two new species for Carol Skoglund and Carole Hertz, both of whom have worked indefatigably for decades to have a better understanding of the mollusca of the Panamic Province.

Abbreviations

CAS: California Academy of Sciences, San Francisco, USA.

CH: Carole Hertz collection, San Diego, California, USA.

KK: Kirstie Kaiser collection, Puerto Vallarta, Mexico.

LACM: Los Angeles County Museum, Los Angeles, California, USA.

LM: Lauretta Marr collection, Johnson City, Tennessee, USA.

EFG: author's collection

SBMNH: Santa Barbara Museum of Natural History, Santa Barbara, California, USA.

USNM: United States National Museum, Washington, D.C., USA

dd: empty shell

lv: live mollusk

spec: specimen

SYSTEMATICS

Family EPITONIIDAE S. S. Berry, 1910

Genus *Cirsotrema* Mörech, 1852

Type species: *Scalaria varicosa* Lamarck, 1812, by original designation.

Key to Panamic Province *Cirsotrema*

- | | |
|--------------------------------------|----------------------|
| A. Axial interspaces clearly visible | <i>C. togatum</i> |
| Axial interspaces not visible | B |
| B. Shell profile strongly tabulated | <i>C. skoglundae</i> |
| Shell profile not tabulated | <i>C. hertzae</i> |

Cirsotrema togatum

Hertlein & Strong, 1951
Figs 1-5, 17

Type material. Holotype (Fig. 1) length 37.5 mm, width 13.8 mm; CAS 065015. Paratype (Fig. 2) 14 mm. SE of Punta Judas. Costa Rica, 9°19'32"N, 84°29'30"W, 76-112 m, CAS 065516.

Type locality. MEXICO: Gorda Banks, Golfo de California, Baja California Sur, 23°1'N, 109°27'30"W; 91 m.

Material examined. MEXICO: Bahía de los Angeles, Baja California Norte, 28°05'N, 113°31'W, 22-38 m, 1 dd, SBMNH 423135. S. of Tetas de Cabra, Sonora State, 27°56'12"N, 111°04'15"W, 50-100 m; 4 lv, 2 dd, SBMNH 423137. SE of Punta San Antonio, Sonora State, 27°54'N, 111°04'32"W, 60-90 m, 1 dd, SBMNH 149423. Islas Ballenas, Ballenas Channel, Baja California Sur, 26°55'N, 113°09'30"W, 238-366 m, 1 lv, SBMNH 129029. Isla Danzante, Baja California Sur, 25°45'27"N, 111°14'36"W, 45-75 m, SBMNH 149425. Isla Danzante, Baja California Sur, 25°45'27"N, 111°14'36"W, 45-75 m, 4 dd, SBMNH 149422. NE of Isla Danzante, Baja California Sur, 25°45'N, 111°14'W, 91-122 m, 1 dd, SBMNH 87382. Punta Coyote, Baja California Sur, 24°21'N, 110°16'W, 30-45 m, 1 dd, SBMNH 87381. Los Frailes, Baja California Sur, 23°22'N, 109°24'W, 45-60 m, 2 lv, SBMNH 87383. ECUADOR: Black Beach, Isla Floreana, Islas Galápagos, 1°16'S, 90°29'W; 10-25 m, 1 dd, SBMNH 423140. Isla Santa Fe, Islas Galápagos, 0° 49'S, 90° 04'W, 50 m, 1 dd, SBMNH 423136.

Other material. MEXICO: Bahía Tenacatita, Jalisco State, 19°17'N, 104°50'W; 37-73 m; 1 spec.; LACM 38-7.28. (Skoglund & Hertz, 2010)

Distribution. From Bahía de los Angeles, Baja California Norte, Mexico, to Panama Bay; Islas Galápagos.

Remarks. The species was described by Hertlein & Strong (1951: 89) as having "narrowly tabulated" whorl, 20 axial ribs on last whorl of the 10-whorl holotype, "of which every fourth, fifth or sixth is swollen to form a varix", and with a spiral sculpture of 7 cords in the interspaces between the axial ribs". The basal cord is highly ornamented, as it is composed of the widening of the primary axial elements, and in some cases only adjacent to each other (SBMNH 423137). These characters readily separate *C. togatum* from the other two Panamic *Cirsotrema* described herein: *C. hertzae* n.sp (Figs 6-10, 18) does not have tabulated whorls, and has a different ornamentation, and *C. skoglundae* n. sp. (Figs 11-14, 19) has widely tabulated whorls, similar to those of the western Atlantic species *C. dalli* Rehder, 1945 (Figs 15-16). The largest specimen of *C. togatum* I examined measures 37.7 mm and has 7.5 whorls, with several earlier whorls missing (SBMNH 423139).

Cirsotrema togatum is not an uncommon species in the Gulf of California; however, it is rarely collected south of Mexico. Olsson (1971) reported this species from the Gulf of Panama, and Keen (1971: 428) reported it from "Baja California south to the Galápagos Islands". The paratype of *C. togatum* from Costa Rica, the specimen figured by Olsson from Panama, and a specimen from Islas Galápagos examine by me have all of the essential characters of the holotype. The only two important variables in the material examined are the number of varices and the strength of ornamentation.

Cirsotrema togatum seems to be morphologically more similar to some of the Indo-Pacific *Cirsotrema*, such as *C. plexis* Dall, 1925, than to its western Atlantic congeners. It is the only one of the three species treated here that has been found in Islas Galápagos.

Cirsotrema hertzae n. sp.
Figs 6-10, 18

Epitoniium (Cirsotrema) togatum Hertlein & Strong, 1951- DuShane, 1974: 35, fig. 54.

Cirsotrema togatum Hertlein & Strong, 1951- Weil, Brown & Neville, 1999: 146, fig. 446.

Type material. Holotype (Figs 6-7, 10, 18) 26.5 mm in length, 8.8 mm in width, SBMNH 149427. Paratypes: MEXICO; S. of Tetas de Cabra, Sonora State, 27°56'12"N, 111°04'15"W, 50-100 m, 2 lv, 3 dd, SBMNH 87384. Isla Candelero, Sonora, 27°55'33"N, 110°59'36"W, 18 m, 1 lv, SBMNH 87385. Isla Candelero, Sonora, 27°55'33"N, 110°59'29"W, 18m, 2 lv, SBMNH 87378. Punta Colorado, Sonora State, 27°54'30"N, 110°58'20"W, depth unknown, 2 dd, SBMNH 149429. SE of Punta San Antonio, Guaymas, Sonora, 27°54'N, 111°04'32"W, 55-82 m, 2 lv, 2 dd, SBMNH 423139. Isla Danzante, Baja California Sur, 25°47'41"N, 111°16'55"W, 30-45 m, 4 lv, 5 dd, SBMNH 149427.

Isla Danzante, Baja California Sur, 25°47'15"N, 11°15'30"W, 30.5 m, 1 lv, 1 dd, SMBNH 149426. Isla María Cleofas, Islas Tres Marías, Nayarit State, 21°19'0"N, 106°13'30"W, 18-36 m, 1 dd, SBMNH 21938. Punta Julupán, Colima State, 19°04'49"N, 104°23'40"W, 31 m, 3 lv, SBMNH 87377; 1 lv USNM 1146210. **PANAMA:** Coibita I., Veraguas Province, 8° 19' 0 N, 81° 10'60 W, 50 m, 1 lv (CH).

Type locality. Isla Danzante, Baja California Sur, W. Mexico, 25°47'41"N, 111°16'55"W, 30-45 m.

Other material examined. MEXICO: Isla Candelero, Sonora, 27°55'33"N, 110°59'29"W, 18m, 1 dd, SBMNH 83658. Isla María Cleofas, Islas Tres Marías, Nayarit State, 21° 16' N, 106° 13' 60" W, 18-21 m, 1 dd.(KK). **COSTA RICA:** Playas del Coco, Guanacaste, 10°34'36"N, 85°42'32"W, 24-37 m, 1 dd, SBMNH 149431 **PANAMA:** Off Punta Gorda, Golfo de Chiriquí, 8°18'0"N, 82°17'60"W, 25 -37 m, 1 lv (LM). Islas Secas, Golfo de Chiriquí, 07°57'24"N, 82°0'43"W, 18-37 m, 1 lv (LM). Islas Secas, Golfo de Chiriquí, 07°57'24"N, 82°0'43"W, 18-37 m, 2 lv (EFG 18571).

Other material. MEXICO: Isla San Pedro Nolasco, Sonora, 27°58.6'N, 111°22.7'W, 170-496 m, 1 spec., LACM 40-36. North of Punta La Gringa, Bahía de los Angeles, Baja California, 29°02.5'N, 113°32.5'W, 31 m, 1 spec., LACM 76-7. Manzanillo; 19°04'N, 104°22'W, 55 m; 1 spec., CAS 06518. (Skoglund & Hertz, 2010)

Description. Holotype (Figs 6-7,10, 18) 26.5 mm in length, narrowly turreted (width/ length ratio 0.33). Protoconch missing. Teleoconch of 10 whorls; first 4 whorls shouldered; remaining whorls slightly convex, not shouldered. Axial sculpture of first 4 whorls of thin, ruffled lamellae; lamellae narrower than interspaces, crossing over sutures, joining adjacent whorls, forming crown at shoulder, each lamella progressively multiplying laterally, filling in former interspaces, developing a series of four axially oriented pits where each primary axial element meets the next; smaller, wrinkled, semilunar pits of various strengths forming where cusps of ruffled lamellae meet; elongation of axial elements developing into "buttresses", crossing suture after fifth whorl; "buttresses" creating a series of large pits; 14 such pits on each of last two whorls. Spiral thread predominant on adapical half of first whorl, crossing axial elements, showing only in interspaces and on side of axial lamellae on later whorls, this obscured by appearance of additional axial lamellae, showing only through openings of ornamentation; secondary microscopic pattern of slightly slanted spiral threads developing on summit of congregated axial lamellae, creating a fenestrate pattern as they cross lamellae; five wide, low spiral bands developing on surface of secondary ornamental pattern; surface of bands

covered with same fenestrate pattern as rest of whorl; bands as wide as interspaces, more prominent on varices. Basal cord (Fig. 10) strong, wide, sculptured with same microscopic fenestrate pattern as surface of whorls, outlined adapically by continued deep sutural pits of last whorl, and abapically by second spiral row of more elongated pits created by narrowing of axial elements. Peristome complete, sub-circular; outer and basal lip with thick varix, slightly patulous abapically; surface of varix covered with same ornamentation as whorls. Shell chalky-white; aperture shiny-white. Operculum black, with central nucleus.

Remarks. The only perceived variables from the holotype in the material examined are the number of varices, which may increase to 7 on a ten-whorl specimen, and the intensity of the ornamentation (Fig. 8). Some specimens begin to create the "buttress" elements on the 6th whorl. All specimens studied are readily separable from their congeners in the Panamic Province. The largest specimen reported (CAS 06518) measures *ca.* 39 mm (Skoglund & Hertz, 2010: 24).

Cirsotrema hertzae can be separated from *C. togatum* by the shell profile, which is smoothly elongate, rather than tabulated; by the "buttress" elements that cross over suture; by the fusion of axial lamellae that cover the entire surface of the whorls, instead of having the distinctly separated axial elements of *C. togatum* (compare Figs 17 and 18); by having 14 primary axial elements on last whorls, as defined by pits and "buttresses", instead of 20 for *C. togatum*; by having less convex whorls; and by a wider, less ornamented basal cord (compare Figs 5 and 10).

Cirsotrema hertzae differs from *C. skoglundae* n. sp., by its slender, non-tabulated profile; by the "buttress" elements that cross the suture; by the pattern of larger axially oriented pits, which in *C. hertzae* consist of 14 rows of four, one for each primary axial element, while *C. skoglundae* shows a honeycomb pattern of larger pits that cover the surface of the whorls (compare Figs 18 and 19); and by having 14 primary axial elements on last whorls, *vs.* 25 for *C. skoglundae*. *Cirsotrema hertzae* seems to be morphologically more similar to its Indo-Pacific congeners, such as some forms of *C. varicosum* (Lamarck, 1822) that develop buttress-like elements across the suture, rather than to its Atlantic congeners.

Etymology. Named for Carole M. Hertz who, together with Carol Skoglund questioned the single-species approach to *C. togatum*. Mrs. Hertz has published numerous malacological articles and has been the editor of *The Festivus*, the well-known publication of the San Diego Shell Club, since 1976.

Cirsotrema skoglundae n. sp.

Figs 11-14, 19

Type material. Holotype (Figs 11-12, 14, 19) 12.2 mm in length, 6.4 mm in width, SBMNH 149430.

Paratypes: **MEXICO:** Punta La Gringa, Bahía de los Angeles, Baja California Norte, 29°01'56"N, 113°31'11"W, 20-40 m, 1 lv, 1 dd, SBMNH 149430. Bahía de los Angeles, Baja California Norte, 28°56'N, 113°31'W, 44 m, 1 lv, SBMNH 87379. Bahía de los Angeles, Baja California Norte, 28°56'N, 113°31'W, 30-45 m, 1 dd, SBMNH 87376. Isla Danzante, Baja California Sur, 25°45'27"N, 111°14'36"W, 45-75 m, 1 dd, SBMNH 149424. **COSTA RICA:** Playas del Coco, Guanacaste Province, 10°34'36"N, 85°42'32"W, 24-37 m, 1 lv, 1 dd, SBMNH 149428; 1 dd USNM 1146211. Islas Viradores, Guanacaste Province; 10°34'N, 85°34'W, 10-25 m, 1 dd, SBMNH 97582. Isla Negritos Adentro, Punta Arenas, 9°49'14"N, 84°51'25"W, 12-27 m, 1 dd, SBMNH 87380.

Type locality. Punta La Gringa, Bahía de los Angeles, Baja California Norte, 29°01'56"N, 113°31'11"W, 20-40 m.

Other material examined. **PANAMA:** Islas Secas, Golfo de Chiriquí; 07°57'24"N, 82°0'43"W, 18-37 m, 1 lv. (LM). Islas Secas, Golfo de Chiriquí, 07°57'24"N, 82°0'43"W; 18-37 m, 1 lv (EFG 29646).

Description. Holotype (Figs 11-12, 14, 19) 12.2 mm in length, widely tabulated (with/length ratio 0.52). Protoconch missing. Teleoconch of 6.5 whorls; whorls strongly shouldered, straight-sided, abapically incurved; shoulders excavated. Suture deep. Axial sculpture of approximately 25 thin, ruffled axial lamellae on early whorls; lamellae wider than interspaces; each lamella incrementally adding lamellae laterally on later whorls, eventually filling-in interspaces, creating beehive pattern of pits as crests of ruffles meet next axial element; axial elements on excavated shoulder first narrowing, then enlarging as they approach suture, creating large pits; similar process occurring pre-suturally, at base of whorls; 25

such pits at either end of whorls; seven axial elements becoming varicoid on last three whorls. Spiral sculpture of numerous spiral threads on interspaces and up abapertural side of lamellae, visible on later whorls only through pits; secondary spiral pattern, slightly diagonal to axis of shell, developing on top of fused axial lamellae, creating a fenestrate pattern when crossing axial elements. Basal cord thin (Fig. 14), rather sharp, sculptured with same fenestrate pattern as surface of whorls, delineated adapically by a series of large pits, a continuation of presutural pits of last whorl, and abapically by elongated pits, again produced by sharp narrowing of axial elements. Peristome complete, subcircular; labral varix rather narrow, patulous at anterior and posterior ends; inner lip thin, erect adapically. Shell white. Operculum missing.

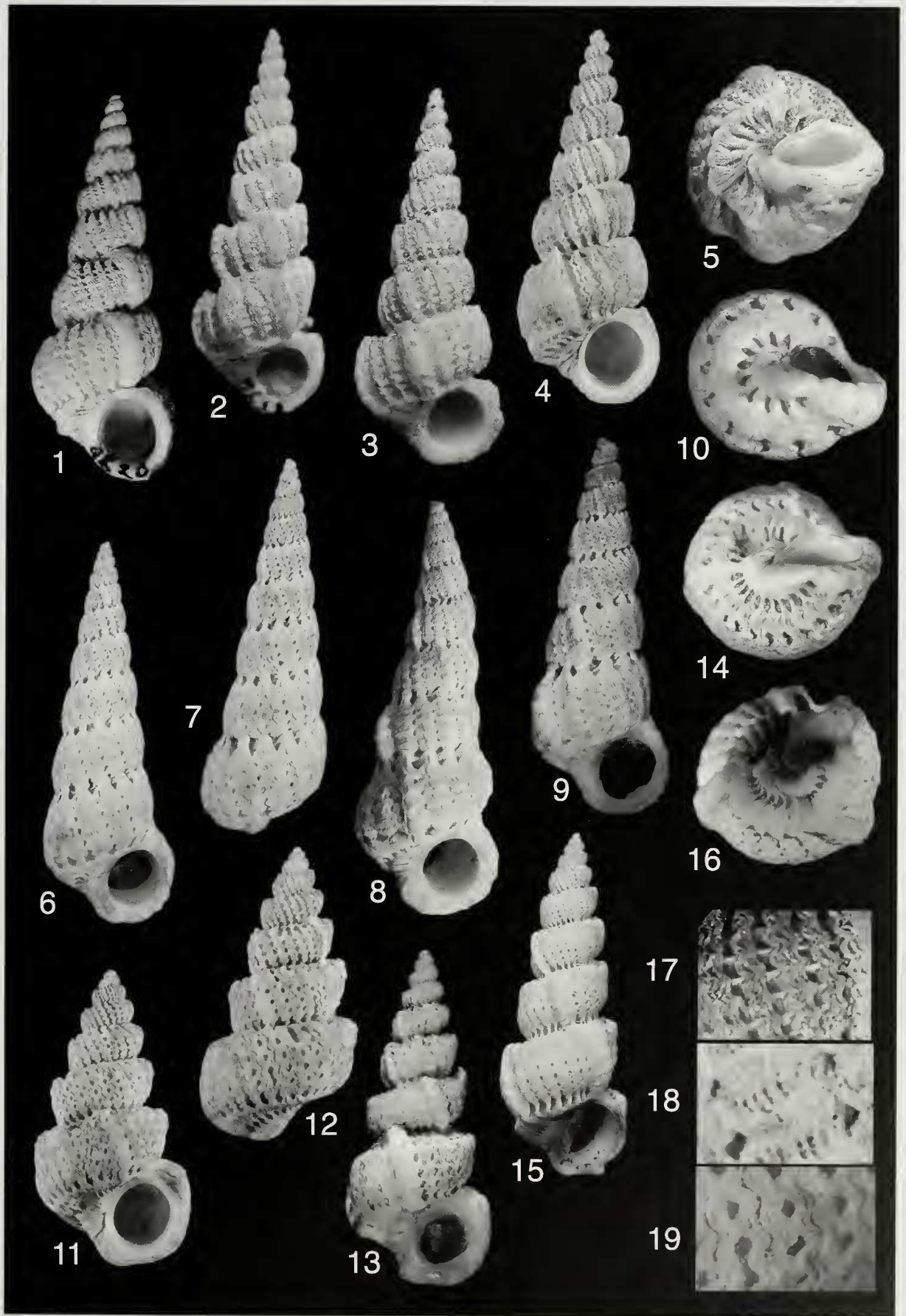
Remarks. All specimens examined, distributed from the Gulf of California to Costa Rica and Panama, conform with the holotype on all main characters; variables are the number of varices and strength of ornamentation. Specimens collected alive show a black operculum with a central nucleus.

Cirsotrema skoglundae differs from *C. togatum* by its more widely tabulated profile, its lack of clearly separated axial elements (compare Figs 17 and 19), its beehive pattern of pits (Fig. 19), and its smaller size. The largest known *C. skoglundae*, an eight-whorl specimen from Panama (Fig. 13) (LR), measures 16.2 mm vs. 37.7 mm for *C. togatum*.

Cirsotrema skoglundae can be separated from *C. hertzae* by its strongly tabulated profile, beehive pattern of pits (compare Figs 18 and 19), the thin, sharp basal cord, and small size. *C. hertzae* has a slender, non-tabulated profile with "buttress" elements crossing the suture, has deep pits only along its 14 primary axial elements, has fewer principal axial elements (14 vs. 25), has a wider, smoother basal cord (compare Figs 10 and 14), and grows to 39 mm.

Figures 1-16

1-5, 17. *Cirsotrema togatum* Hertlein & Strong, 1951. **1, 17.** Holotype length 37.5 mm, width 13.8 mm, CAS 065015 (photo G. Metz). **2.** Paratype, 14 mi. SE of Punta Judas. Costa Rica, 9°19'32"N, 84°29'30"W, 76.5-112 m. CAS 065516 (photo G. Metz). **3.** Isla Santa Fe, Islas Galápagos, Ecuador, 0° 49'S, 90° 04'W, 50 m, 32.6 mm, SBMNH 423136. **4-5.** SE of Punta San Antonio, Sonora State, 27°54'N, 111°04'32"W, 60-90 m, 23.3 mm, SBMNH 149423 (photos, D. Geiger). **6-10, 18.** *Cirsotrema hertzae* n. sp. **6-7, 10, 18.** Holotype 26.5 mm in length, 8.8 mm in width, Isla Danzante, Baja California Sur, W. Mexico, 25°47'41"N, 111°16'55"W, 30-45 m., SBMNH 149427. **8.** Coibita I., Veraguas Province, Panama, 8° 19' 0 N, 81° 10'60 W, in 50 m, 31.2 mm (CH). **9.** Islas Secas, Golfo de Chiriquí, 07°57'24"N, 82°0'43", Panama, 12-25 m, 24 mm (EFG 18571). **11-14, 19.** *Cirsotrema skoglundae* n. sp. **11-12, 14, 19.** Holotype 12.2 mm in length, 6.4 mm in width, Punta La Gringa, Bahía de los Angeles, Baja California Norte, 29°01'56"N, 113°31'11"W, 20-40 m, SBMNH 149430 (photos Patricia Sadeghian). **13.** Islas Secas, Golfo de Chiriquí, 07°57'24"N, 82°0'43"W, 18-37 m, 16.2 mm (LM). **15-16.** *Cirsotrema dalli* Rehder, 1945, Bahía de Porto Bello, Panama, 37 m, 19.2 mm (EFG 8578).



Cirsotrema skoglundae is very similar to *C. dalli* Rehder, 1945 (Figs 15-16), its Atlantic cognate; however, *C. dalli* has taller whorls, more pronounced presutural pits due to a sharper, longer constrictions of axial elements, more varices, "of which there are two to three in each whorl" (Rehder, 1945: 128), a "prominent", much wider, less ornamented basal cord (Fig. 16), and grows to a much larger size. The type of *Cirsotrema dalli* (USNM 515240) measures 41 mm (Rehder, 1945: 128)

Etymology. Named for Carol Skoglund who, together with Carole Hertz questioned the single species approach to *Cirsotrema togatum*. Mrs. Skoglund has published numerous malacological articles and has kept up-to-date, almost single-handedly, A. Myra Keen's monumental work on Panamic mollusks (see Skoglund, 2002).

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